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# U. S. DEPARTMENT OF AGRICULTURE

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## EMMER AND SPELT



**E**MMER AND SPELT are kinds of wheat the kernels of which are not removed from the chaff in threshing. Emmer and spelt are commonly but wrongly called speltz.

Emmer was introduced into this country from Russia over 50 years ago. The States leading in the production of emmer are South Dakota, North Dakota, Nebraska, Minnesota, and Colorado. About 344,000 acres of emmer and spelt (mostly emmer) were grown in 1929. Spring emmer is best adapted to eastern North Dakota and South Dakota, but even there it usually yields less than the best varieties of barley or oats. Winter emmer is not an important crop in any part of the United States.

The Vernal (White Spring) or common emmer is the most productive spring variety, although Khapli appears promising in some sections. Both of these varieties are very resistant to stem rust.

Black Winter emmer is not very winter hardy or very resistant to rust or drought.

Spring emmer yields best when sown early at the rate of 6 to 8 pecks per acre.

Spelt is grown only on limited acreages, mostly in the eastern half of the United States. Winter spelt should be sown at the rate of 8 to 12 pecks per acre at the time winter wheat is sown.

Emmer and spelt are used principally as feed for livestock and have a feeding value about equal to oats and somewhat less than barley and corn. They also are used for making breakfast foods. Emmer and spelt are not suitable for the manufacture of bread-making flours in this country.

# EMMER AND SPELT

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## WHAT ARE EMMER AND SPELT?

**EMMER AND SPELT** are kinds of wheat that are grown to a limited extent in the United States. They differ from other wheats in that most of the kernels are not removed from the chaff (glumes) in threshing. The heads of both are fragile and break up during the threshing operation, leaving most of the meshes (spikelets) whole with the kernels enclosed (figs. 1 and 2). Some of the kernels always thresh out, however, the proportion depending on the adjustment of the threshing machine and the moisture content of the grain and straw at the time of threshing.

Emmer and spelt differ considerably in the shape and compactness of the heads and in other characters (figs. 3 and 4). The kernels of emmer and spelt are somewhat similar, being red in color and semi-hard or hard in texture. The kernels are long, slender, and tapering and have a long pointed brush. The uses of the two crops are much the same, but they are adapted to growing under very different conditions.

The name "speltz" is commonly used for both emmer and spelt by farmers and seedsmen in this country. The names "Russian oats," "spelz," and "spilts" also have been used. As emmer and spelt are distinct crops the word "speltz" should be discarded, and they should be known by their proper names.



FIGURE 1.—Emmer spikelets, showing short and pointed pedicel attached to base.

Another kind of wheat, called einkorn, the kernels of which remain enclosed in the chaff like emmer and spelt when threshed, is not grown by farmers in the United States and therefore is not discussed in this bulletin.<sup>1</sup>

#### EMMER



FIGURE 2.—Spelt spikelets, mostly without pedicel attached to base.

Emmer usually has pithy stems and velvety leaves. The heads are very compact and are flattened on the sides. The pedicels (joints of the rachis or stem of the heads) are short, narrow, and pointed and usually remain attached to the lower end of the meshes when threshed (fig. 1). The meshes are flattened on the inner side and contain two (or sometimes three) kernels.

#### HISTORY

Emmer apparently has been grown since prehistoric times. It still is grown in many parts of Europe and Asia, although it is becoming of less importance. It is often of considerable importance, however, where agricultural conditions are unfavorable, as in some parts of the Union of Soviet Socialist Republics. Emmer probably was introduced into this country more than 50 years ago by German immigrants from southern Russia who settled in the Dakotas. Other lots of emmer have since been introduced and distributed by the United States Department of Agriculture.

#### DISTRIBUTION

The States leading in the production of emmer are South Dakota, North Dakota, Nebraska, Minnesota, and Colorado, in the order named. Approximately 344,000 acres of emmer and spelt combined were grown in the United States in 1929, or somewhat less than the acreage 20 years before. The section producing the largest quantity of emmer lies in the eastern Dakotas. The distribution of emmer in the United States in 1929 is shown in figure 5.

#### ADAPTATION

Emmer has been regarded as a drought-resistant crop and has been recommended for semiarid regions. Experiments and experience in this country, however, have shown that it is not as productive as adapted varieties of wheat, oats, and barley under conditions of limited rainfall. Emmer is better suited to some subhumid sections

<sup>1</sup> For further information concerning these crops, see U. S. Department of Agriculture Bulletin No. 1197, Experiments with Emmer, Spelt, and Einkorn.

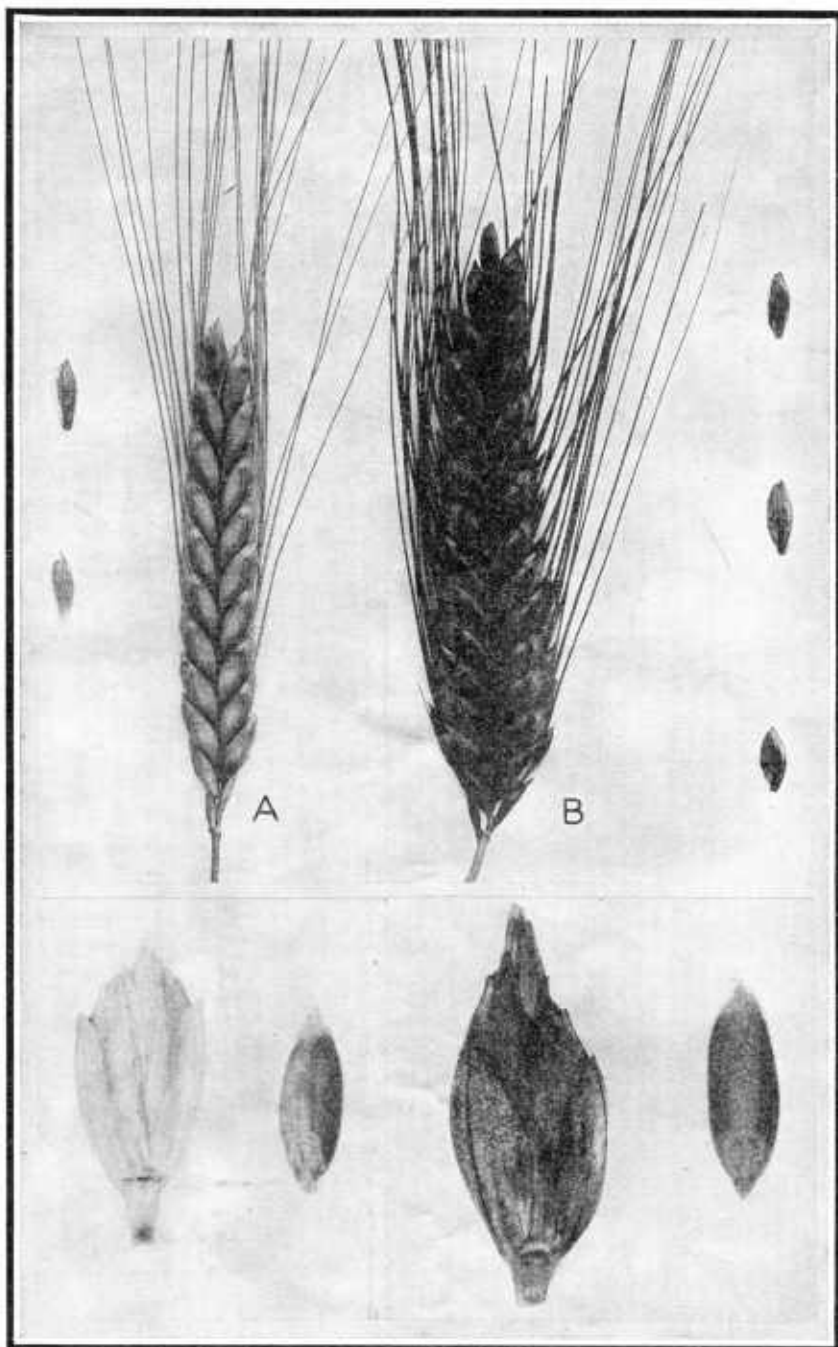


FIGURE 3.—*A*, Vernal emmer; *B*, Black Winter emmer. Spike, side view, natural size; glumes from lower, central, and upper portions of spike, natural size; spikelet and kernel, magnified 3 diameters.

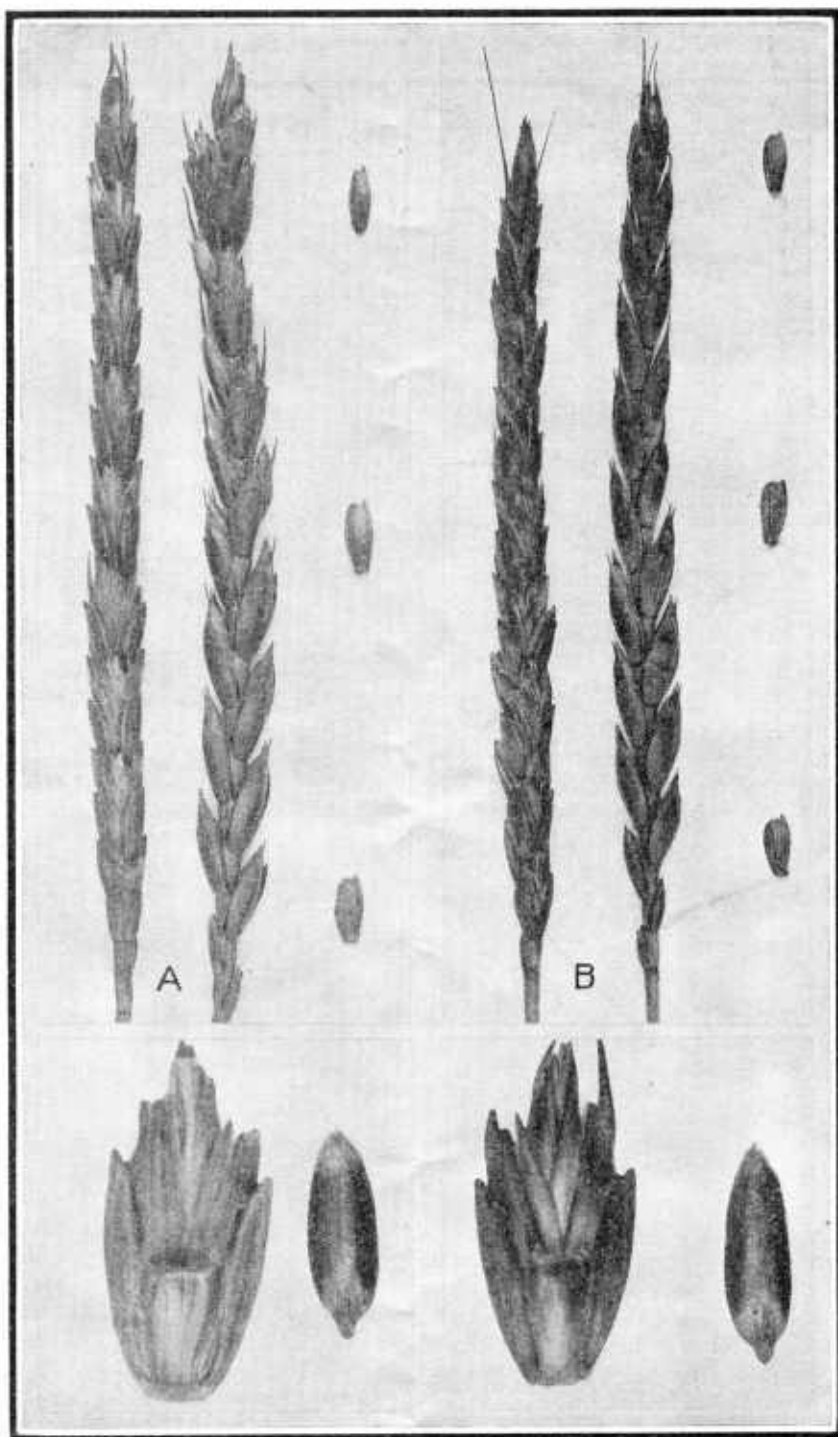


FIGURE 4.—A, White Spring spelt; B, Red Winter spelt. Spikes, face and side views, natural size; glumes from lower, central, and upper portions of spike, natural size; spikelet and kernel, magnified 3 diameters.

than to the semiarid regions, and in the semiarid regions it gives better results in comparison with other small grains in moist seasons than it does in very dry seasons; in fact, it sometimes is a complete failure in dry seasons when certain varieties of other grains produce at least a partial crop.

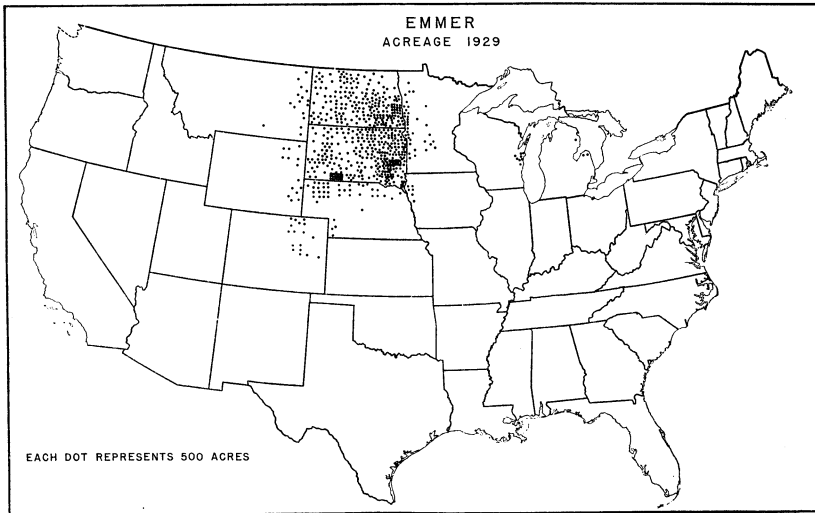


FIGURE 5.—Outline map of the United States, showing the distribution of emmer in 1929, according to the United States census. Estimated area, 344,000 acres. Each dot represents 500 acres.

Spring emmer is best adapted to the eastern portions of North Dakota and South Dakota and to western Minnesota. There it yields only slightly less than oats and barley, the feed grains with which it competes, but in some seasons it outyields both of these crops. As spring emmer is very resistant to rust the growing of this crop offers a means of avoiding serious rust losses and may thus have a small place in the farming system because it permits greater diversification and thereby spreads the crop risks. In general, however, it is less profitable than other grains. Outside of the region just mentioned, spring emmer on an average cannot compete with the better varieties of barley or oats, or both.

Winter emmer is not successful in the East or in the northern half of the United States because of its late maturity and lack of hardiness. In the Great Plains and Mississippi Valley it is not sufficiently hardy to survive the winter temperatures which occur in most seasons in the region north of Kansas. Winter emmer has given the best results in Utah and Arizona, and even there the yields of threshed grain without the hulls are less than the yields of winter wheat. Winter emmer is thus not well suited for growing in any part of the United States, although some of it still is grown in Colorado and other States.

#### VARIETIES

A number of varieties of emmer have been introduced into this country, but only the three discussed here are now known to be grown commercially.

## VERNAL (WHITE SPRING)

The Vernal (White Spring) or common emmer is the grain usually grown in this country as speltz. It was first brought to the United States by German-Russian immigrants and grown in the Dakotas. In 1898 samples of this variety were introduced into the United States by the Department of Agriculture under the names Ufa and Yaroslav. Vernal is the only variety of emmer of any importance in this country now.

The Vernal variety has slender, nodding, bearded heads about 2 to 2½ inches long, glabrous (not velvety) white or yellow chaff, and purplish stems (fig. 3, *A*). It is very resistant to rust and is seldom injured by smut. It is grown only from spring sowing. In numerous experiments comparing Vernal with other emmer varieties in the Great Plains and prairie regions, it has, with few exceptions, given the highest average yields. With the possible exception of Khapli, Vernal should probably be the only variety of emmer grown in this country.

## KHAPLI

Khapli, or Kathiawar, emmer was introduced from India by the Department of Agriculture in 1908 and was distributed in 1917 from the Highmore substation of the South Dakota Agricultural Experiment Station. A small acreage of this variety may perhaps still be grown in South Dakota. Khapli differs from the Vernal variety principally in being earlier and in having shorter stems and wider heads. It is nearly immune from stem rust.

Khapli has given somewhat higher yields than Vernal in South Dakota and Colorado and therefore is of some promise in those States, although it frequently is rather short and somewhat difficult to harvest.

## BLACK WINTER

Black Winter emmer was introduced from France by the Department of Agriculture in 1904 and was distributed to farmers later. Only a limited acreage, most of which is in Colorado, is now grown, because of the frequent losses from winter-killing. A field of Black Winter emmer growing in Texas is shown in figure 6. A mass selection of this variety identical with the original strain was distributed in Wyoming about 1910 as "Buffum's Improved Black Winter emmer."

Black Winter has large bearded heads which are wide in one direction and narrow in the other. The chaff is bluish black or brownish black in color (fig. 3, *B*). Sometimes the heads are branched when grown under very favorable conditions. The plants are tall and are late in maturing. Black Winter emmer is not resistant to stem rust or drought. It is not so hardy as most varieties of winter wheat, but is more hardy than winter varieties of barley and oats.

In all comparative experiments, reports of which are available, Black Winter emmer has yielded less than the leading variety of barley or oats and often is outyielded by both of these crops except at Nephi, Utah. The advantage of the leading variety of barley or oats, however, has not been large at McPherson, Kans., Channing, Tex., or Phoenix, Ariz. At Nephi, Utah, neither barley nor oats is

well adapted, and winter wheat, the leading small-grain crop, produces higher yields of threshed grain without the hulls than does Black Winter emmer. This variety of emmer could generally be displaced by other crops with profit.

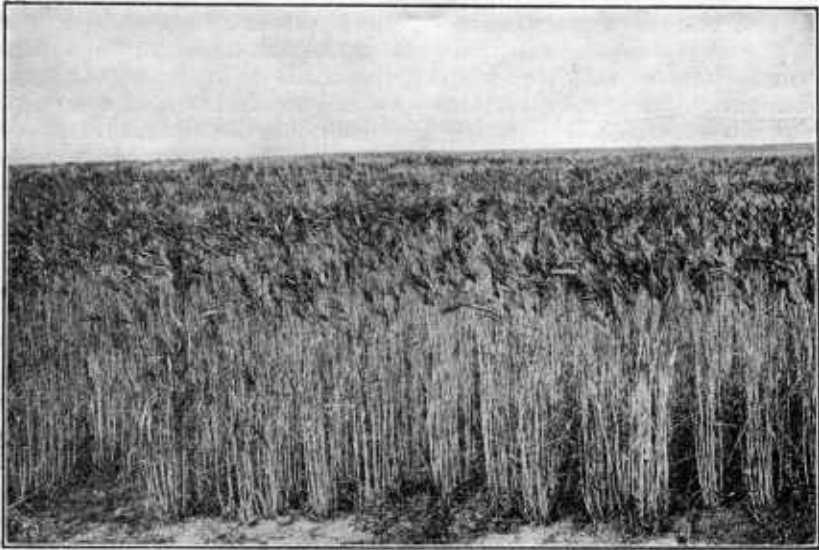


FIGURE 6.—A field of Black Winter emmer growing at Channing, Tex.

#### CULTURE

##### SPRING EMMER

In the sections where spring emmer is adapted, it should be sown as early in the spring as soil conditions permit. The best results have been obtained when it was sown with the grain drill at 6 to 8 pecks per acre, which is about the rate used for oats in the semiarid and subhumid sections. The drill should be adjusted as it is for sowing oats. Emmer requires the same soil preparation as other spring grains and occupies a similar position in crop rotations. In comparative experiments the most profitable crops of emmer have been obtained on corn ground, where the cost of production has been low.

##### WINTER EMMER

Winter emmer should be sown with the grain drill at the rate of 6 to 8 pecks per acre in semiarid sections. The best results are obtained if it is sown at the time most favorable for winter wheat. A depth of sowing of 1 to 3 inches is most satisfactory.

#### HARVESTING AND THRESHING

The heads of emmer are easily broken at maturity, and therefore the crop should be harvested before it is dead ripe to avoid losses from shattering. Emmer is harvested and shocked in the same manner as wheat, oats, or barley. It is threshed easily, but care should be taken to avoid dehulling too many of the kernels. When threshed,

most of the kernels should remain enclosed in the chaff. The adjustment of the threshing machine is practically the same as for threshing oats.

#### SPELT

Spelt usually has rather large hollow stems and glabrous (not velvety) or slightly velvety leaves. The heads are long, slender, and open, with the meshes far apart and arched on the inner side. The pedicel (joint of rachis or stem of the head) is long and wide and after threshing usually remains attached to the face of the mesh below the one which it bears (fig. 2). Both bearded and beardless and winter and spring varieties of spelt are known. The winter varieties usually will produce seed from spring sowing in the spring wheat area unless sown very late. Most varieties are rather tall.

Spelt can be distinguished from emmer easily by its long slender heads and by the longer, wider, and different attachment of the pedicels and by its larger hollow stems. The kernels of spelt are more flattened than those of emmer. Except for their manner of breaking up in threshing, spelt and emmer do not have many characteristics in common.

#### HISTORY

Spelt has been grown in Europe for 200 years, and probably much longer. It has been introduced into the United States on numerous occasions, several introductions having been made during the nineties. It was grown experimentally in California as early as 1893. More recently samples of spelt have been imported from Germany by the Department of Agriculture. After these introductions had been grown experimentally for a few years, seed was distributed to a few farmers in the Eastern and Southern States.

#### DISTRIBUTION

Statistics on the distribution of spelt alone in this country are not available, but apparently only a few hundred acres are grown. The data on spelt and emmer are combined in census reports. In 1929 about 344,000 acres of these two crops were grown in the United States, most of which was emmer. Most of the spelt is grown in the eastern half of the United States, although occasionally it is found in other sections. As farmers and seedsmen frequently apply the name speltz to both of these crops, reports on them are somewhat indefinite.

#### ADAPTATION

Only winter spelt is grown in the eastern United States. In this region it generally yields less than the most productive varieties of oats and barley, and, since it is not popular as a feed crop, there is little or no reason for growing it where these crops are satisfactory.

In experiments with spelt at the Arlington Experiment Farm, Arlington, Va., it has been observed that spelt produces larger net yields of grain (kernels only) than wheat in years and under conditions where wheat is badly lodged. Spelt lodges less than wheat, oats, barley, or rye and may sometimes be grown to advantage on heavy soils where lodging is common. Spelt is less winter hardy than the more hardy winter wheats and should not be grown north of Maryland and Virginia.

## VARIETIES

Although many varieties of spelt are known in Europe and several have been grown experimentally in this country, only two are now known to be grown commercially on a small acreage in the United States. Both are winter varieties and are described here. Neither is resistant to stem or leaf rust or loose or covered smut. They apparently are as winter hardy as most varieties of winter wheat. The winter-killing of spelt has not been experienced over a period of more than 10 years in the vicinity of Washington, D. C., and the coldest winters during this time have not reduced the yields.

One variety of spring spelt, White Spring (fig. 4, *A*), was distributed formerly by a seed firm in New York, but apparently it is not now grown on farms in the United States.

## ALSTROUM

The variety Alstroum has long, slender, open, nodding beardless heads with glabrous (not velvety) white or yellow chaff (fig. 7). The stems are yellow, with sometimes a purple tinge. Although a winter variety, Alstroum will mature seed rather late in northern localities even when sown in the spring. This variety was obtained by the Department of Agriculture in 1901 from the Washington Agricultural Experiment Station, by which it had been introduced from Asia.

Considerable quantities of Alstroum spelt have been distributed to farmers by the Department of Agriculture from the Arlington Experiment Farm. It is now grown to some extent in Maryland, Virginia, and North Carolina. Several farmers have reported good yields and general satisfaction with the crop. It should be given a thorough trial as a feed crop in these States.

## RED WINTER

Red Winter or Red spelt differs from the Alstroum variety principally in having red or brown chaff and in having a few short-tip beards on the heads (fig. 4, *B*). In height, time of maturity, and color of stems Red Winter is very similar to Alstroum and, like the latter variety, can be matured from spring sowing in northern localities. This variety appears to be more hardy than any variety of winter emmer.

Doubtless several lots of Red Winter spelt have been introduced from Europe. A sample was obtained by the Department of Agriculture in 1901 from the Washington Agricultural Experiment Station, by which it had been introduced from Asia. Seed of this variety, under the name Brown Winter, also was introduced from Switzerland about 1913 by a farmer in South Dakota, who distributed it 2 years later. It was sown on a considerable acreage in the Black Hills district of South Dakota and Wyoming, but was almost entirely winter-killed during the rather severe winters which followed, and very little, if any, of this spelt is now grown. Red Winter spelt also has been distributed by the Department of Agriculture and several experiment stations, but it is not extensively grown.

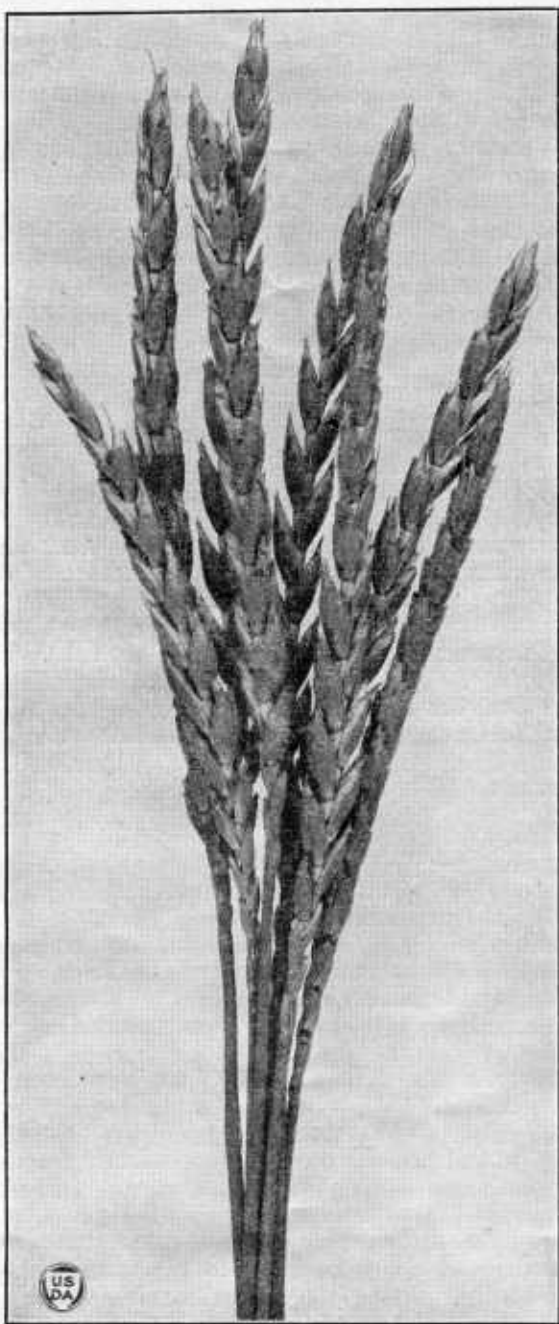


FIGURE 7.—Heads of Alstroum spelt.

This variety has yielded about as well as Alstroum in Maryland and Virginia. It is the most promising variety of spelt in the southern Great Plains and the Great Basin regions, where it usually out-yields Black Winter emmer. Because it has not compared favorably with winter wheat and some other crops, however, it has not become commercially important even in these regions.

#### CULTURE

The culture of spelt is very similar to that of wheat. The preparation of the soil, the rotations, and the fertilizers are the same for both crops. Spelt also should be sown at the best time for sowing wheat. It should be sown with the grain drill at the rate of 8 to 12 pecks per acre in the Eastern States, but less in semiarid regions. In order to sow at these rates it may be necessary to set the drill to sow a somewhat larger quantity, because the large grains pass through the drill rather slowly.

In drilling spelt and emmer on the Arlington Experiment Farm it has been the practice to set the drill feed as if sowing barley or oats. This has resulted in sowing about 70 to 90 pounds of seed per acre, which has given a fairly good stand but somewhat thinner than the usual stand of wheat. The presence in seed spelt of sticks, straws, and parts of spelt heads not fully broken up will interfere with proper feeding through the drill. Removal of such material by fanning and screening will result in more even seeding and a better stand.

Both spelt and emmer are slower in germinating than wheat, probably on account of the chaff which covers the kernels. In order to provide for the additional moisture which appears to be needed for germination, it has been the practice at the Arlington Experiment Farm when the seedbed is dry to seed both spelt and emmer somewhat deeper than wheat is sown.

#### HARVESTING AND THRESHING

The heads of spelt are brittle and break up in threshing with the kernels enclosed in the chaff (glumes) rather than shelled free, like wheat. In very dry regions or when the grain becomes dead ripe before cutting, there may be some loss in the field from this breaking up of the head. The kernels are held very tightly, however, and if cutting takes place before the crop is dead ripe the losses from shattering in cutting and handling spelt apparently have not been as large as occur in wheat, oats, and barley.

Spelt is threshed with the ordinary threshing machine. Some attention should be given to adjusting the concave properly in threshing spelt. If the teeth are too close, too many kernels will be broken and shelled out from the chaff. If they are too far apart, many of the heads will not be completely broken up. Entire heads or heads only partially broken up make difficult the proper cleaning by the machine and later will interfere in sowing the grain with a drill. Attention must also be given in threshing to use the proper riddles in the machine for cleaning the threshed grain.

## USES OF EMMER AND SPELT

As ordinarily threshed, most of the kernels of emmer and spelt remain enclosed in the hulls, or chaff, which comprise about 20 to 30 percent of the total weight of the grain. In chemical composition, emmer and spelt are somewhat similar to oats, and experiments indicate that these grains are about equal to or slightly better than oats and somewhat inferior to barley and corn in feeding value. The kernels of emmer and spelt with the hulls or chaff removed have about the same composition as wheat.

Nearly all of the emmer and spelt grown in the United States is fed to livestock. It should be ground before being fed. Because of their bulk, emmer and spelt give better results when mixed with other grains or concentrates, such as corn, barley, or linseed meal. The straws of emmer and spelt are about equal in feeding value to wheat straw, although stock will sometimes leave wheat straw for spelt straw.

In Europe emmer and spelt often are used in making food products. Sometimes they are dehulled and ground into a meal which is used for porridge. Some emmer is being milled into an uncooked breakfast food in this country. In Germany spelt sometimes is harvested before it is ripe, and the dried immature kernels, called grünkorn, are used in soups, porridge, etc.

Flour from emmer and spelt produces an undesirable dark, heavy bread; when flour is made, it is used mostly in mixtures with wheat flour. These crops are not suitable for the manufacture of bread-making flours in this country.

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